



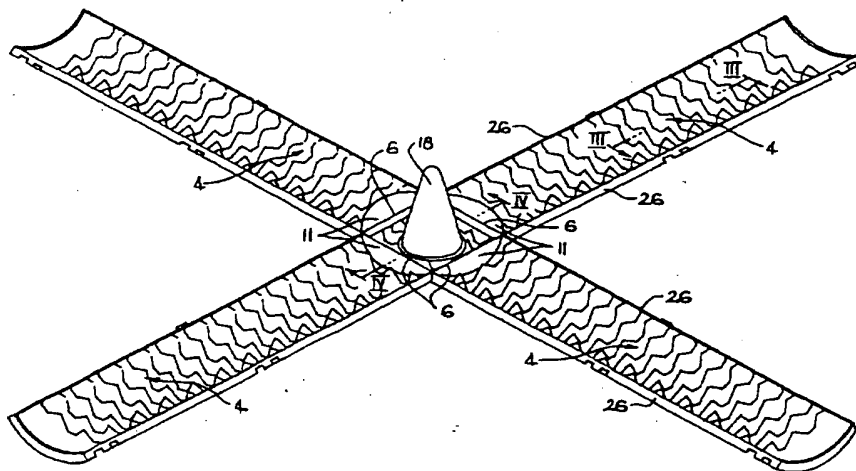
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(54) Title: PLANT CONTAINER WITH TRANSFORMABLE WALLS

(57) Abstract

A plant growth container which is transformable between operational and non-operational conditions in which it can and cannot respectively retain a body of growing medium. The container (1) includes a base (2) and a side wall structure (3) which upstands from the base (2) and has a tube-like configuration when the container (1) is in the operational condition. The side wall structure (3) is composed of a plurality of side wall sections (4) which cooperate to form the tube-like configuration and which are movable relative to one another and to the base (2) to transform the container (1)



from one condition to the other. For that purpose the lower end of each wall section (4) can be pivotably or otherwise connected to the base (2). Each of the side wall sections (4) and the base (2) of the container may be provided with a plurality of openings (7, 8) so as to promote air pruning of the root structure of a plant growing within the container (1). The container (1) can be combined with a support tray (13) having locating means (16) which cooperates with the lower end of the container (1) to position the container (1) at a predetermined location on the tray (13). A cover (32) of the support tray (13) has an opening (33) which receives the container (1), and the part of the cover (32) surrounding that opening (33) functions as a retaining ring which holds the container wall sections (4) against movement away from one another. The container (1) can be used in an automated plant propagation system in which the container is transformed from the non-operational condition to the operational condition, a growing medium is deposited into the container, and a seed or seedling is deposited into the growing medium. Subsequent opening of the container and removal of a growing plant may be also automated.

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PLANT CONTAINER WITH TRANSFORMABLE WALLS

This invention relates to plant growth containers of the kind used to provide a suitable environment for a growing plant during part of the growth cycle of that plant. It will be convenient to hereinafter describe the invention with particular reference to containers for seedlings, but it is to be understood that the invention has wider application.

Seedling containers are generally of a relatively small size and consequently tend to confine the root growth of the plant as the plant develops. It is therefore necessary to transfer the plant to a larger container before root growth becomes too confined, and such transfer may occur on several occasions as the plant progressively develops. Transfer of the growing plant from one container to another involves the risk of damage being caused to the plant, and particularly the root system of the plant. Also, a cost factor is associated with each transfer and for that reason it is desirable to keep the transfers to a minimum.

A number of attempts have been made to alleviate the risk of damage to the plant root structure during propagation, but the proposals to date have not been entirely satisfactory. One proposal which has been adopted with some success is to provide the container walls with apertures to permit the laterally extending roots to move through the container walls and be air pruned. That technique minimises the problem of circular growth and bunching of the laterally extending roots, but it does not by itself address the problem of transferring the growing plant from a small container to a larger container. Australian patents 576677 and 629067 disclose containers which are intended to assist the propagation process and minimise circling or other root damage, but neither has proven to be entirely satisfactory and neither is well suited for the initial growth stages of a seedling.

There is a need to automate the process whereby seeds are deposited in containers for initial seedling growth, and that has lead to the development of multi-cavity seedling trays. Such trays can be fed through a station at which the plant growing medium is deposited in each cavity and a subsequent station at which a seed or seeds is or are placed in each cavity. Individual containers

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of the kind disclosed by Australian patents 576677 and 629067 do not conveniently lend themselves to such automatic processing.

It is an object of the present invention to provide a plant growth container which facilitates orderly development of the root structure of a contained plant and which facilitates transfer of the growing plant to another container. It is a further object of the invention to provide such a container which is conveniently useable in an automated seed placement process. Still another object of the invention is to provide a container which increases the shelf life of a plant and thereby decreases the number of occasions on which the plant needs to be transferred from one container to another.

With regard to the foregoing "shelf life" is to be understood as the period of time over which a plant can be kept in a particular container without serious detriment to the health and growth potential of the plant. Prior to the present invention the typical shelf life of a propagated plant was considered to be approximately three weeks, whereas it is estimated that a shelf life of approximately twelve weeks, and possibly longer, can be achieved by use of a container according to the present invention. At the very least a container according to the invention enables a significant extension of the shelf life achieved with prior containers.

A plant container according to the invention is characterised in that it is transformable between operational and non-operational conditions. In the operational condition a side wall structure of the container has a tube-like configuration so as to form an enclosure around a cavity in which a body of plant growing medium can be retained. When the container is in the non-operational condition the side wall structure is arranged so that the cavity either does not exist or has inadequate integrity to satisfactorily retain a body of growing medium.

It is preferred that the container includes a base to which the side wall structure is connected, and that the side wall structure is formed of two or more wall sections which are relatively movable so as to effect the aforementioned transformation. Each wall section may be hingedly or otherwise connected to the base so as to enable the relative movement. With such an arrangement

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the wall sections stand up from the base in side by side relationship to create the tube-like configuration when the container is in the operational condition. In order to adopt the non-operational condition each wall section is swung outwardly about its connection with the base towards a position at which the
5 base and wall sections resemble a substantially flat container blank.

The side wall structure and the base of the container may be perforated to enable air pruning of the growing root system of a plant supported within the container. It is preferred that root guiding recesses are formed at the inner surface of both the side wall structure and the base and that an opening is
10 provided at the base of each such recess to permit passage of the growing root system. Roots which enter such openings are air pruned in a known manner. Each root guiding recess may be of a truncated pyramidal or conical form as generally disclosed by the specification of Australian patent 629067.

A container according to the invention is ideally suited for use in
15 automated plant potting systems. The container can be supplied to a nursery in flat blank form and can be quickly transformed into the tube-like operational condition either manually or by automatically operable means.

Means could be provided to support at least one operational container in an upright position for passage through a potting station at which a quantity of
20 plant growing medium and at least one seed are deposited into the container through the open top. It will usually be the case that the growing medium and the seed are deposited at different moments in time.

The container support means may comprise a tray-like body having locating means on a floor thereof arranged to be engageable with cooperable
25 means provided on the container base. As a result of that engagement the container is retained in such a way as to permit rapid and accurate deposition of a seed.

Removal of a plant from the container is also achieved in a simple and speedy manner as hereinafter explained.

30 Embodiments of the invention are described in detail in the following passages of the specification which refer to the accompanying drawings. The drawings, however, are merely illustrative of how the invention

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might be put into effect, so that the specific form and arrangement of the various features as shown is not to be understood as limiting on the invention.

In the drawings:

5 Figure 1 is a semi-diagrammatic perspective view of one form of container according to the invention when that container is in the operational condition.

Figure 2 is an enlarged view of the container according to Figure 1 which shows the container in the non-operational condition.

10 Figure 3 is an enlarged cross-sectional view taken along line III-III of Figure 2.

Figure 4 is a cross-sectional view taken along line IV-IV of Figure 2.

Figure 5 is an enlarged view of the lower end portion of the container of Figure 1, shown in side elevation.

15 Figure 6 is a semi-diagrammatic perspective view of one form of support tray for use with the container of Figure 1.

Figure 7 is an enlarged perspective view of a locating peg of the kind included in the support tray of Figure 6.

Figure 8 is a perspective view of another form of support tray for use with the container of Figure 1.

20 Figure 9 is a perspective view of a support tray with one container mounted on the tray.

Figure 10 is a view similar to Figure 5 but showing the container being transformed into the non-operational condition.

25 Figure 11 is a view similar to Figure 5 but showing a modified form of connection between the side wall sections and the base of the container.

Figure 12 is a view similar to Figure 11 but showing the wall section of the container moved into the non-operational condition.

Figure 13 shows part only of a modified form of container according to the invention.

30 Figure 14 shows the upper portion of a container according to the Figure 13 embodiment when in the operational condition.

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Figure 15 is a view similar to Figure 14 and showing a further modification of the invention.

Figure 16 shows in perspective view another form of support structure for a container according to the invention.

5 Figure 17 is a cross-sectional view of a combination of containers according to the invention and a support structure for such containers.

Figures 18 to 21 show in diagrammatic form a plant propagation system including the use of a container according to the present invention.

10 Figure 22 shows the upper end portion of another embodiment of the invention.

In the particular example shown by Figure 1 of the drawings the container 1 comprises a base 2 and a tube-like body 3 upstanding from that base 2. The container may be made of any suitable material and may be formed in any suitable manner, but it is preferred that the container 1 is formed
15 as a single piece such as by moulding of a plastics material. Examples of suitable materials are polypropylene and high density polyethylene. The body 3 is made up of a plurality of side wall sections 4 arranged side by side and which cooperate to enclose a cavity 5 in which a body of growing medium can be retained. In the example shown there are four side wall sections 4, but a
20 greater or lesser number could be adopted.

The container 1 is initially formed as a flat blank in which the side wall sections 4 radiate out from the base 2, and adjacent wall sections 4 extend at substantially 90° relative to one another as shown by Figure 2. In the particular arrangement shown, the inner or lower end of each wall section 4 is connected
25 to the base 2 through a live hinge 6 so as to enable the wall sections 4 to be moved relative to the base 2 between the conditions shown by Figures 1 and 2 respectively. Figure 1 shows the container 1 in the operational condition as previously described, and Figure 2 shows the container in the non-operational condition. Any suitable retaining means may be employed to hold the side wall
30 sections 4 in cooperation as shown by Figure 1. Preferably, that retaining means is releasable and may include integrally moulded clip means as hereinafter described.

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The facility to transfer a growing plant from one container to another is optimised if the plant root system is allowed to develop in an orderly fashion. One method of achieving that is to contain the plant in an environment which permits air pruning of the root system. In the particular example shown, openings 7 are provided through each side wall section 4, and similar openings 8 are provided through the base 2. The radical and other downwardly extending roots of the root system extend into the openings 8 and are thereby subjected to air pruning, whereas laterally extending roots of the plant root system extend into the opening 7 and are thereby subjected to air pruning.

It is preferred that each opening 7 is associated with guide means which functions to guide a root into the opening 7. In the particular example shown such guide means is formed by a recess 9. Each recess 9 has a longitudinal axis extending transverse to the longitudinal axis of the cavity 5, and it is preferred that the transverse cross-sectional size of each cavity 9 progressively decreases in a direction towards the respective opening 7. Thus, each recess 9 has a sloping inner surface or surfaces which guide an engaging root towards the respective opening 7. Similar recesses 10 are preferably provided in the base 2 as best seen in Figure 4. For the foregoing purpose it may be convenient to form each opening 7 and 8 at the apex of a hollow cusp-like element having the configuration of a truncated cone, pyramid, or the like.

The tube-like body 1 is preferably of generally cylindrical form as shown, but it could be of any other suitable form such as square, hexagonal, octagonal, et cetera. In the case of a cylindrical form as shown it is at least desirable for the axis of each of the hinges 6 to extend in a substantially straight line arranged transverse to the longitudinal axis of the respective side wall section 4. For that purpose it is convenient to form the base 2 so that it has a square or other rectilinear or polygonal peripheral configuration. With such an arrangement a sloping wall part 11 may extend between the hinge line 6 as shown in Figure 2 so as to provide a transition between the straight line configuration of the base 2 and the curved configuration of the wall section 4. Appropriate selection of the distance between the hinge line 6 and the under surface 12 of the base 2 can facilitate moulding of the container in the flat

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blank form as shown by Figure 2.

Assuming the product is to be formed by a moulding process, it is appropriate that the wall sections 4 be formed in circumstances which permit their ready release from the moulding die. If the wall sections 4 are of curved form as in the preferred embodiment, the alternately outwardly and inwardly projecting cusp-like elements could create a die punch withdrawal problem. That problem may be addressed by appropriate selection of the geometry of the cusps which lie along or adjacent the longitudinal edges of each wall section 4.

If the container 1 is intended for use in an automated seed placement process it is preferable that means be provided whereby the container can be accurately positioned to receive a seed or seeds. According to one embodiment of the invention that means includes a container support tray 13 which may be generally of the form shown diagrammatically by Figure 6.

The tray 13 has a floor 14 which may be surrounded by an upstanding continuous wall 14 so as to contain water, for example, deposited on the floor 14. A plurality of locating pegs 16 are arranged upstanding from the floor 14, and those pegs 16 preferably have a predetermined relationship with one another and with the tray body in general. Each peg 16 may have a transverse cross-sectional size which progressively diminishes in a direction away from the floor 14 so as to facilitate location of a container 1 as hereinafter described.

Figure 7 shows one possible form of a peg 16 which is composed of four triangular plates 17 arranged upstanding from the floor 14. Other forms are clearly possible. By way of example, Figure 8 shows an arrangement in which each peg 16 is in the form of a truncated circular cone having a curved or part-spherical upper end surface. The cones may be hollow.

The container 1 is provided with means for cooperating with a peg 16, and in the embodiment shown in the drawings that means includes a conical cavity 18 formed in the under surface 12 of the base 2. Preferably, that cavity 18 is positioned at the center of the base 2 and has a cross-sectional shape to suit that of the pegs 16. By way of example the cross-sectional shape of the cavity 18 may correspond to the shape of a cone or the shape of a multi-sided

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figure such as a regular octagon. The shape and dimensions of the cavity 18 are preferably such that it neatly receives a peg 16 in a manner whereby the position of the container 1 on the tray 13 can be accurately predicted. It is also desirable that the cooperation between the peg 16 and the cavity 18 is such as to securely support the container 1 in an upright position. In that regard, it will be desirable in some instances for the container 1 to be of substantial elongate form - see Figure 9.

It is preferred to form the tray 13 of a predetermined size so that it can form one module of an array of identical trays adapted to be positioned on a conveyor system for transport through a seeding station.

A container according to the invention can be constructed in a variety of sizes and certain aspects of the construction may alter according to the size of the container. By way of example, a different hinge arrangement may be adopted for large and small containers respectively. A live hinge as previously described may be adopted for containers of relatively small size, whereas in the case of relatively large containers it may be convenient to adopt a hinge system which permits the side wall sections 4 to be releasably attached to the base 2.

Figures 11 and 12 show an arrangement in which the hinge system includes two or more hinge sections 19 which are spaced apart in the direction of the hinge axis, and each section 19 is made up of two separable parts 20 and 21. The hinge part 20 of the particular arrangement shown is attached to or formed integral with the lower end 22 of a wall section 4 and includes a hook-like member 23. The other hinge part 21 is formed on or attached to the base 2 and includes an opening 24 which receives the hook-like member 23 and a ledge 25 (Figure 12) beneath which the hook-like member 23 engages when the associated wall section 4 is upstanding as shown in Figure 11. When the wall section 4 is swung outwards to the position shown in Figure 12 the hook-like member 23 can be removed from the opening 24 thereby permitting separation of the wall section 4 and the base 2. It will be apparent that other arrangements could be adopted to achieve the same results.

Figures 1, 2, 5 and 9 show a straight line interface between adjacent

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side edges 26 of wall sections 4. It has been found that the strength of the structure can be improved by arranging the side edges 26 so that they intermesh or interlock. One arrangement which is suitable for that purpose is shown by Figures 13 and 14. In that arrangement a series of alternating projections 27 and recesses 28 is formed along each side edge 26, and each series is arranged so that the projections 27 of each series of a wall section 4 locate within respective recesses 28 of a series of another wall section 4 as shown by Figure 14.

As shown by Figure 14 the strength of the container may be also enhanced by providing an outwardly projecting lip or flange 29 along the upper end of each wall section 4.

Any suitable retaining means may be adopted to releasably hold the container wall sections 4 in the operational condition. Figure 15 shows one form of retaining means which includes a clip 30 provided on the flange 29 of one wall section 4 which snap engages with a recess 31 provided in the upper surface of the adjacent wall section 4. In that arrangement each wall section 4 has a clip 30 and a recess 31 at or adjacent respective side edges 26.

In a preferred arrangement the retaining means includes a ring member which surrounds the container 1, preferably at or adjacent the upper end. When the container 1 is intended to be supported by a multi-container tray 13, the retaining means may include a cover 32 having a series of openings 33 formed therethrough. The number of openings 33 will equal the number of pegs 16, and each opening 33 will be located directly above a respective peg 16 so that each opening 33 and associated peg 16 serves a respective one of the containers 1. The body of the cover 32 which surrounds each of the openings 33 functions as the retaining ring member for the respective container 1. If desired, the retaining means of Figure 16 could be used together with the retaining means of Figure 15.

The cover 32 could be formed separate from the tray 13 as shown by Figure 16, or it could be formed integral with the tray 13 as shown by Figure 17. In the Figure 17 arrangement the tray 13 forms the base of a hollow box 34 which may be produced in any suitable fashion, such as by blow moulding.

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The side wall 35 of the box 34 is preferably continuous to provide a complete surround such that water, for example, can be retained on the base of the box 34. Water may be introduced into the box 34 through feed openings 36 and removed through drain openings 37. Openings 36 and 37 may be provided at one or more corners of the box 34, or at any other convenient location.

It is preferred that each container 1 projects some distance above the cover 32 when supported by a peg 16 as shown in Figure 17. That permits convenient placement of the container 1 into the box 34 and also permits convenient removal from the box 34. Figure 17 also shows how two or more boxes 34 might be stacked one upon the other while containing growing plants 38. In the particular arrangement shown a hollow spacer 39 is provided between two boxes 34 so as to provide a space for the growing plants 39 between the cover 32 of one box 34 and the tray 13 of another. An opening 40, or two or more openings, of suitable size may be provided in at least one side wall 41 of the spacer 39.

The lowermost box 34 shown in Figure 17 may be mounted on a tank 42 which receives water from the drain opening 37 and stores the received water for recirculation through the boxes 34 if required.

Container blanks can be fed in the flat condition shown by Figure 18 to pass through a transformation station at which they are automatically transformed into the operative tube-like configuration. By way of example each blank may be caused to move through a confined space dimensioned to force the side wall sections 4 to hinge inwardly towards one another. The transformed container can then be deposited by appropriate means on to a selected peg 16 of the tray 13 for subsequent transfer to a seeding station. Indeed it is possible to automate every operation between formation of the container blank to deposition of the seeds and subsequent removal of the grown plant.

An operational container can be opened to release a growing plant in an equally convenient manner. Any suitable means can be employed to separate the side wall sections 4 as shown by Figure 10 so that they move outwards towards the disposition possessed when the container is in the flattened blank

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form. Such movement exposes completely the growing plant and the body of growing medium within which it is contained, thereby facilitating transfer of the plant to another container or to the ground.

Figures 18 to 21 show, in diagrammatic form, an example system in which the container 1 progresses from the ready to use flat condition to the plant removal stage. Figure 18 shows the flat container blank being moved towards a transformation station as shown by Figure 19. In the particular example shown, the transformation station includes a cover 32 and the container 1 is transformed into the operational condition by being pushed or dropped downwards through a cover opening 33.

The cover 32 shown in Figure 19 may be the top wall of a box 34 as shown by Figure 20 so that the container is fed directly onto a locating peg 16. The box 34 with the container 1 deposited therein can be fed sequentially through a filling station (not shown) and a seeding station (not shown) at which growing medium and a seed or seedling are deposited in turn into the container 1. Figure 20 shows the assembly at a later stage of the propagation process at which a plant 38 has developed.

The plant 38 can be removed from the container 1 in any suitable fashion. Figure 21 shows a system in which each peg 16 is mounted on a push rod 43 which is operable to move the container 1 upwards through the opening 33. The container 1 may therefore open automatically, or be influenced to open, as shown by Figure 21 so that the plant 38 can be removed either manually or mechanically.

The container 1 may be provided with a plant watering facility, an example of which is shown diagrammatically by Figure 22. In that example the container 1 is provided with a handle 44, at least part of which may be hollow to receive water from a small bore tube 45 connected to the handle 44. Water may be delivered to the tube 45 in any suitable fashion such as by way of a pump 46 connected to the storage tank 42 or another supply source. A spray nozzle 47 may be formed in or connected to the handle 44 and arranged to direct a spray 48 in an appropriate direction.

A container according to the invention can be of substantially elongate

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form so as to enable development of a long radical and tap root system. The number of lateral roots increases in accordance with the length of the radical and tap root system, and the shelf life of a plant is influenced by the number of lateral roots. That is, a plant having a large number of lateral roots which
5 occupy all of the available pore space in the growing media and thus reach an equilibrium state will generally have a longer shelf life than one having a small number of lateral roots which rapidly circle the air space between the growing media and the smooth container wall.

It has also been found that the number of lateral roots is dependent
10 upon the number of openings provided in the container wall or walls to permit air pruning. The side wall structure of a container in accordance with the present invention can have a dense array of openings such that the number of openings in a given area is significantly greater than that existing in prior containers such as the container according to Australian patent 576677. As a
15 consequence, a container according to the present invention can be constructed to optimise plant shelf life.

A container support tray as previously described can be constructed and arranged to allow selection of any appropriate watering system for the plants supported by the tray. By way of example, the tray may have a valve
20 controllable drain which if left open avoids an accumulation of water within the tray. If on the other hand the valve is closed a body of water can be retained in the tray from which the plants can draw moisture, and in that event the valve may be time controlled or otherwise regulated so as to avoid over-watering of the plants.

25 Other benefits of the invention will be apparent from the preceding description.

Finally, it is to be understood that various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the
30 invention as defined by the appended claims.

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CLAIMS:

1. A plant growth container which is transformable between operational and non-operational conditions in which it can and cannot respectively retain a body of growing medium, including a base, a side wall structure which
5 upstands from said base and has a tube-like configuration when the container is in said operational condition, a plurality of side wall sections which co-operate to form said tube-like wall structure and which are relatively movable to transform said container into said non-operational condition, each said wall section having a lower end and an upper end, each said lower end is
10 connected to said base at least when said container is in said operational condition, and said upper ends combine to form an open top of the tube-like wall structure when said container is in said operational condition.
2. A container according to claim 1, wherein hinge means connects each said lower end to said base.
- 15 3. A container according to claim 2, wherein each said hinge means is integral with both said base and the respective said wall section.
4. A container according to claim 2, wherein said hinge means includes two separable parts whereby each said wall section can be separated from said base.
- 20 5. A container according to any one of claims 2 to 4, wherein said hinge means permits said container to be stored in a flat condition in which each said wall section extends laterally outwards from said base.
6. A container according to any preceding claim, wherein said tube-like configuration is substantially cylindrical.
- 25 7. A container according to any preceding claim, wherein the peripheral shape of said base in plan view is the shape of a straight sided polygon, the number of the straight sides of said polygon is equal to the number of said wall sections, and the lower end of each said wall section is connected to a respective one of said straight sides.
- 30 8. A container according to any preceding claim, wherein a plurality of openings is formed through each said wall section so as to promote air pruning of laterally extending roots of the root system of a plant located within said

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container.

9. A container according to any preceding claim, wherein a plurality of openings is formed through said base so as to promote air pruning of downwardly extending roots of the root system of a plant located within said

5 container.

10. A container according to claim 8 or 9, wherein each said opening is formed at the base of a recess having sloping sides surfaces which function to guide a growing root towards the said opening of the respective said recess.

11. A container according to any preceding claim, wherein each said wall
10 section is of substantially rectangular shape and has two substantially parallel side edges each of which extends between the upper and lower ends of the respective said wall section, a series of alternating projections and recess is formed along each said side edge, and each said series is arranged so that the projections of each series of each said wall section locate within the recesses
15 of a said series of an adjacent said wall section when the container is in said operational condition.

12. A container according to any preceding claim, including retaining means which is operable to releasably hold said container in said operational condition.

20 13. A container according to claim 12, wherein said retaining means includes clip means provided on each said wall section which cooperatively engages with an adjacent said wall section.

14. A container according to claim 12 or 13, wherein said retaining means includes a ring member which surrounds said container at or adjacent the
25 upper end of each said wall section.

15. A container according to any preceding claim, wherein said container includes positioning means which is cooperable with a container support to locate the container in a predetermined position on that support.

16. A container according to claim 15, wherein said positioning means
30 includes a cavity formed in the under surface of said base to receive and cooperate with locating means provided on said container support such that the container is retained in said predetermined position.

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17. A container according to claim 16, wherein said cavity is of cone-like formation and is formed in an upwardly projecting part of the base which extends above and is surrounded by an upper surface of a main body of said base.
- 5 18. A container according to claim 16 or 17, wherein said cavity is substantially at the center of said base.
19. A combination of a plant growth container and a container support, wherein said container is in accordance with claim 15.
20. A combination of a plant growth container and a container support,
10 wherein said container is in accordance with any one of claims 16 to 18.
21. A combination according to claim 20, wherein said container support is adapted to support a plurality of said containers, and a respective said locating means is provided for each said container.
22. A combination according to claim 21, wherein said locating means are
15 spaced apart a distance such as to provide a predetermined spacing between containers engaging with adjacent said locating means.
23. A combination according to any one of claims 19 to 22, wherein said container support includes a tray, and the or each said locating means is in the form of a locating peg arranged upstanding from the floor of said tray.
- 20 24. A combination according to claim 23, wherein said tray includes a peripheral side wall which surrounds said floor.
25. A combination according to claim 23 or 24, wherein said tray forms the base of a hollow box, a cover overlies said base, at least one container receiving opening as provided in said cover, and said container receiving
25 opening as positioned in substantially vertical alignment with said locating peg or a respective one of said locating pegs.
26. A combination according to claim 25, wherein said cover is an integral part of said box.
27. A combination according to claim 25 or 26, wherein a water feed
30 opening is provided in said cover and a drain opening is provided in said base.
28. A combination according to claim 27, wherein said drain opening is connected to a water storage tank, and means is provided whereby water can

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be withdrawn from said tank and recirculated through said box.

29. A combination according to claim 27 or 28, wherein one said box is located above another said box, a spacer is provided between said boxes to hold them vertically apart, and the drain opening of the uppermost box is connected through said spacer to the feed opening of the lowermost box.

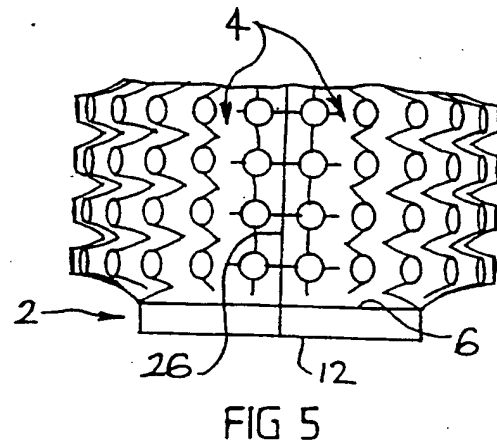
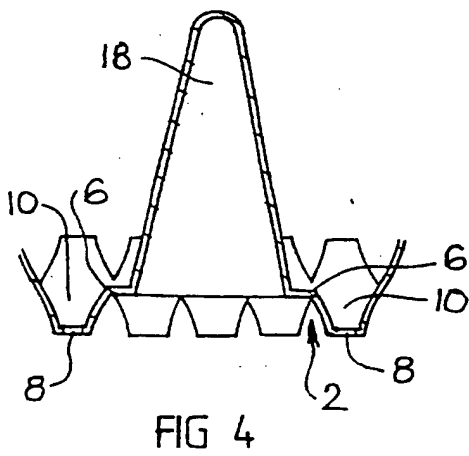
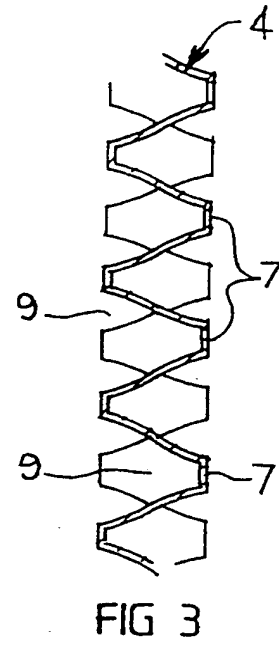
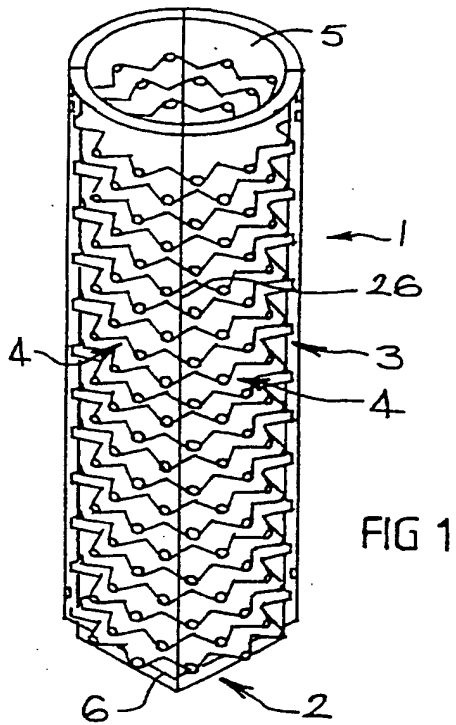
30. A plant propagation system including use of a container according to any one of claims 1 to 18, wherein said container is fed in a relatively flat non-operational condition into a transformation station at which it is caused to adopt said operational condition, a growing medium is deposited into said operational container, a seed or seedling is thereafter deposited into said growing medium, and said container is subsequently opened to adopt said non-operational condition when it is desired to remove a growing plant from the container.

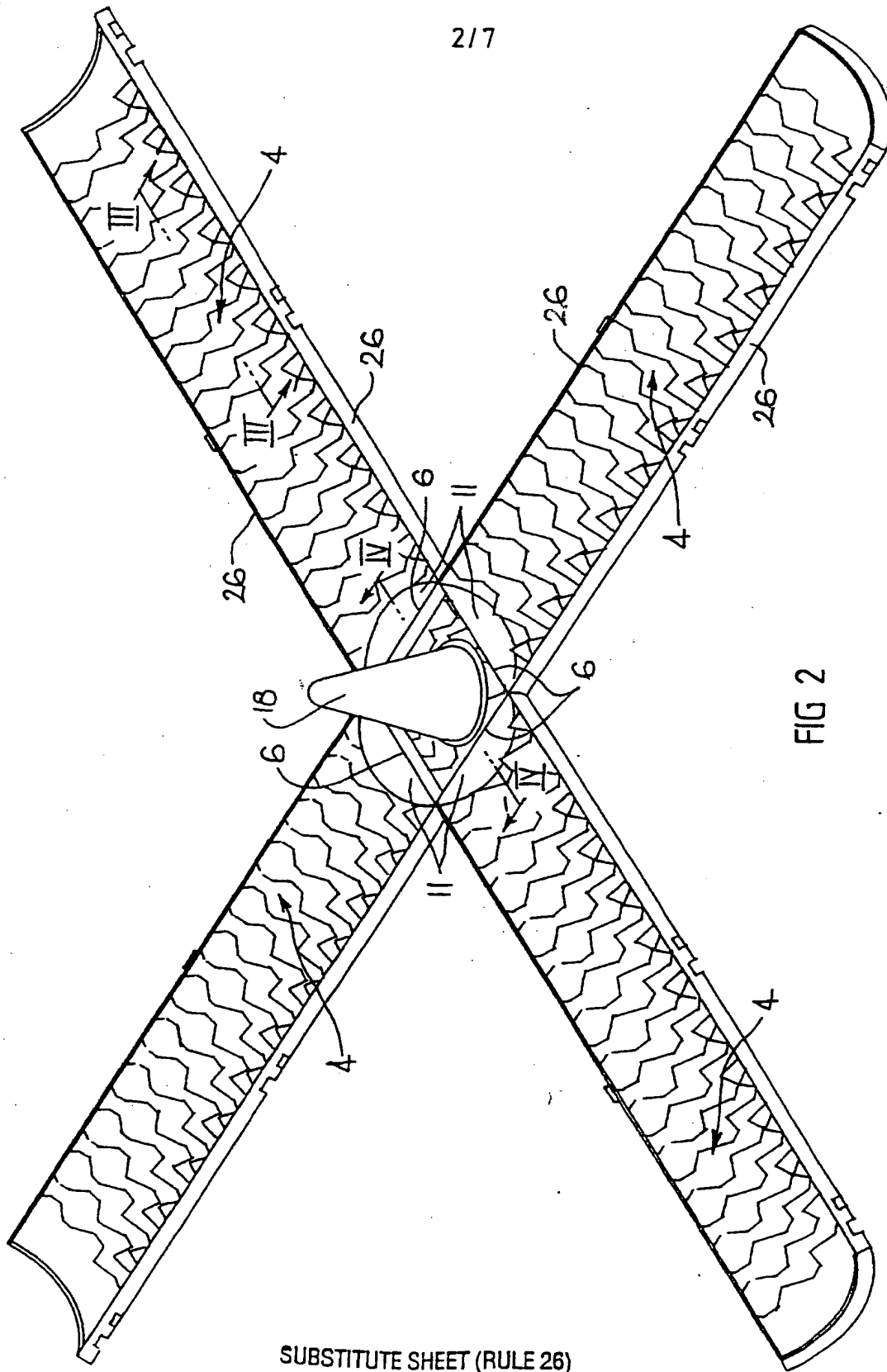
31. A plant growth container substantially as herein particularly described with reference to any one of the embodiments shown in the accompanying drawings.

32. A combination of a plant growth container and a container support substantially as herein particularly described with reference to any one of the embodiments shown in the accompanying drawings.

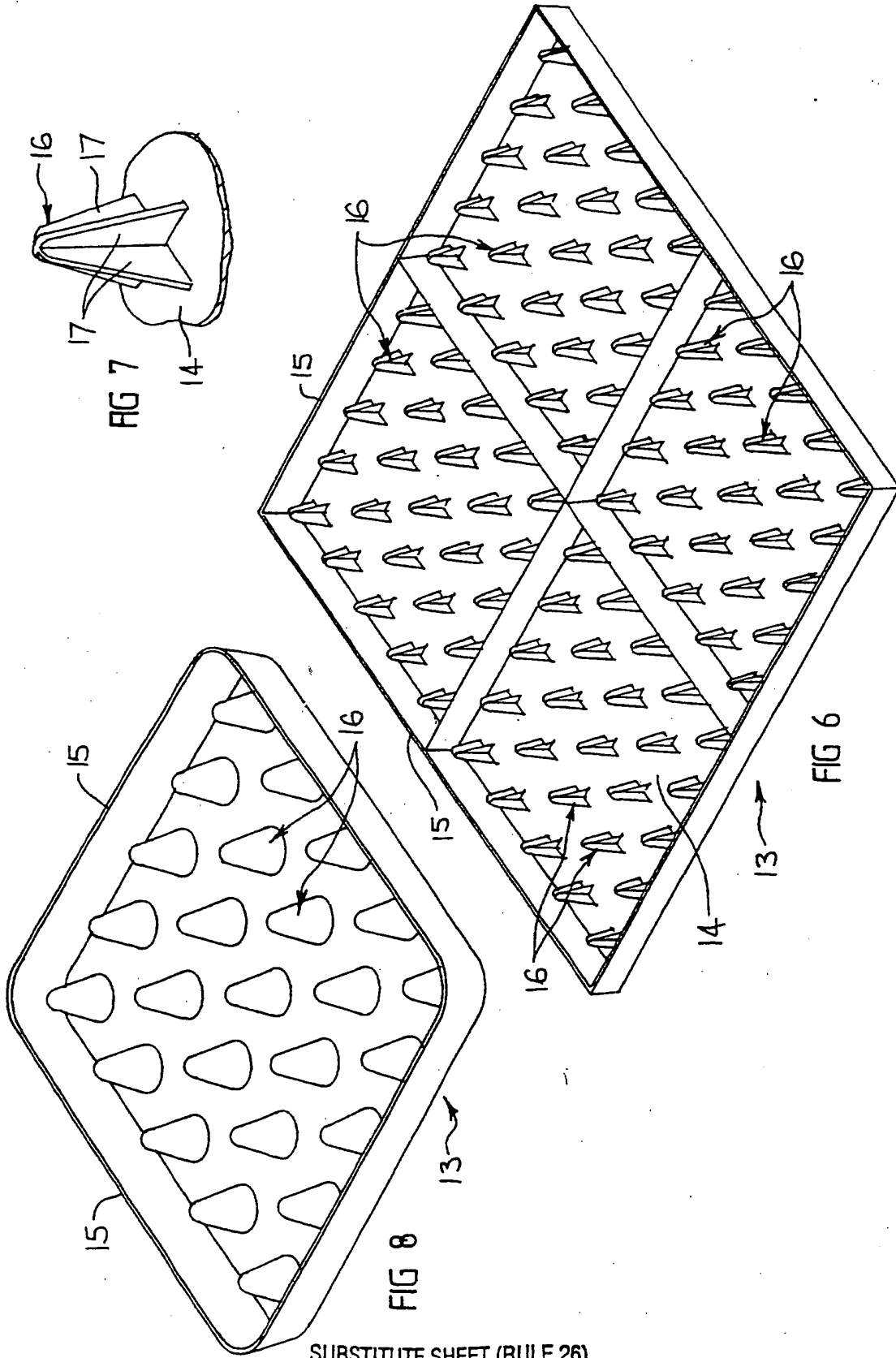
33. A plant propagation system substantially as herein particularly described with reference to the accompanying drawings.

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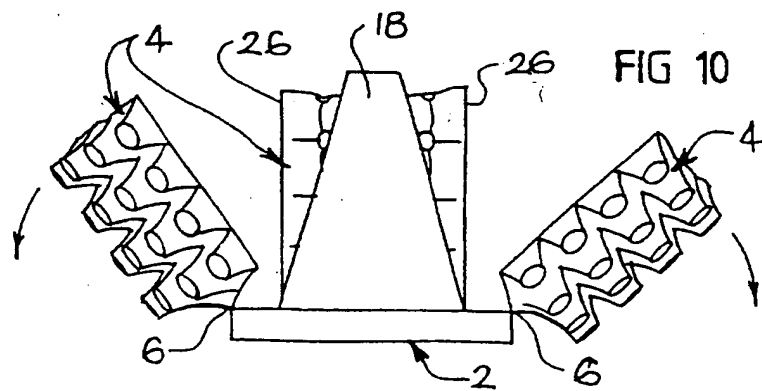
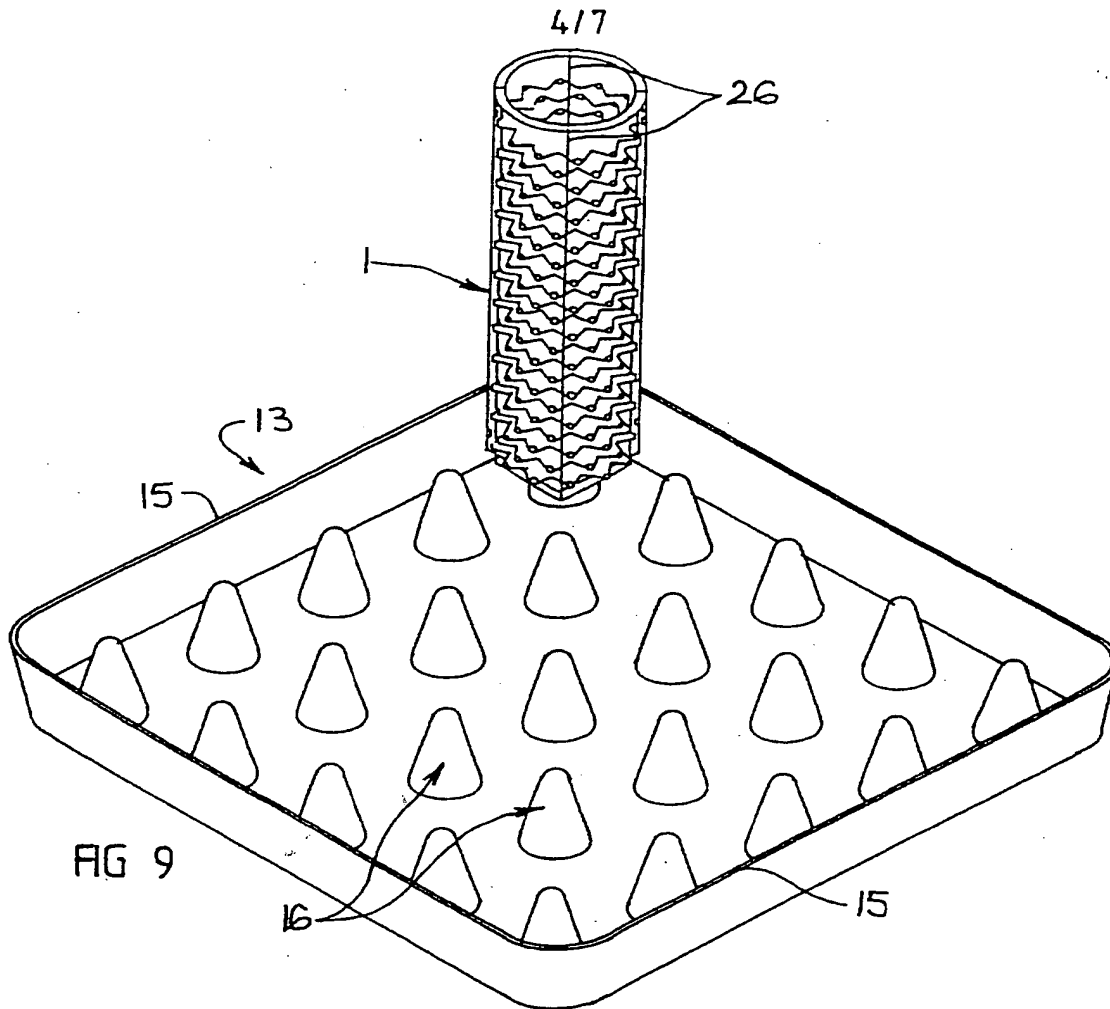




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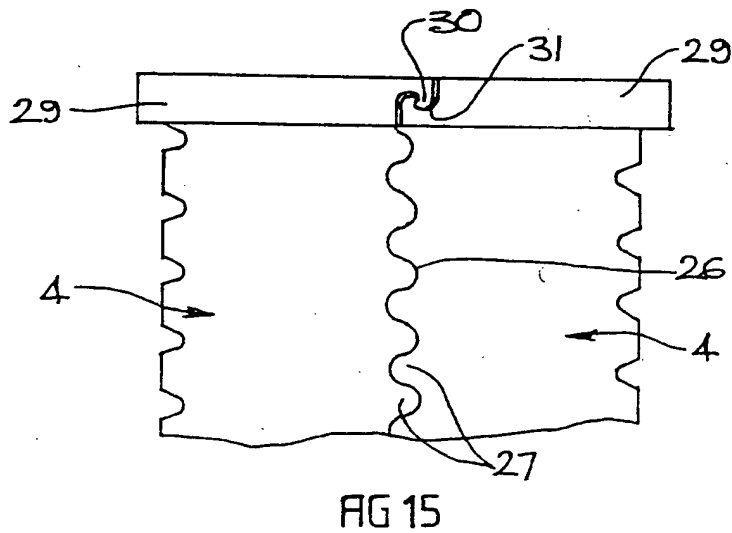
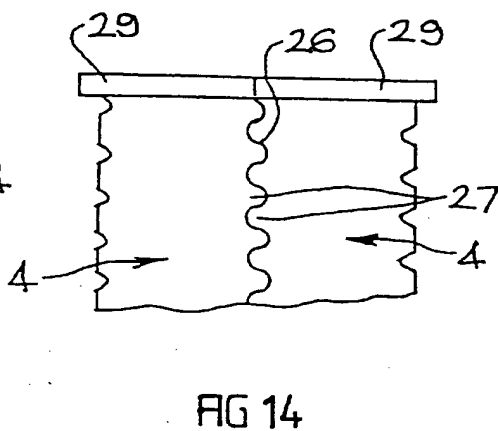
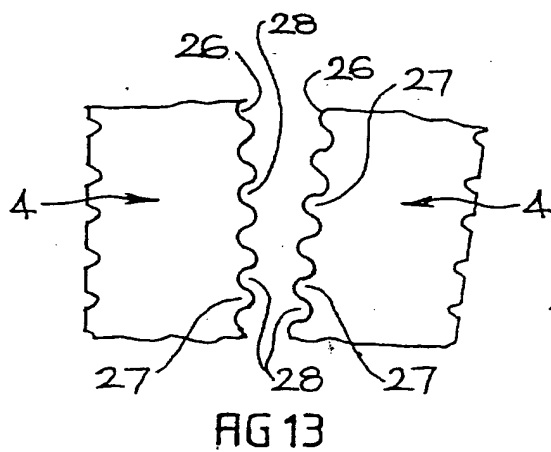
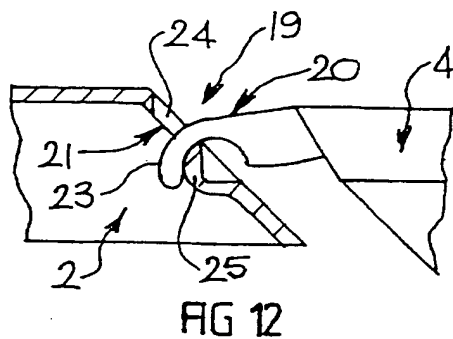
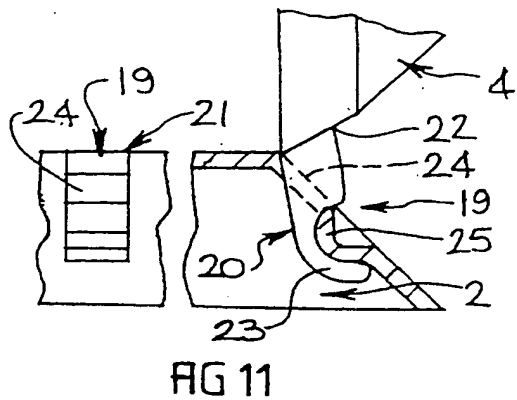


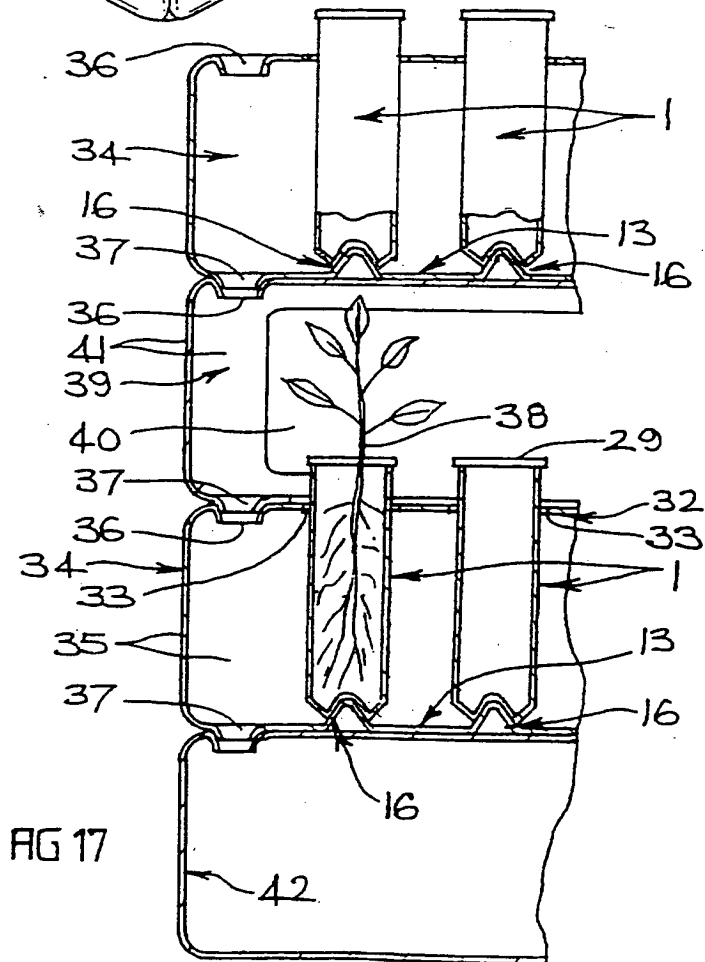
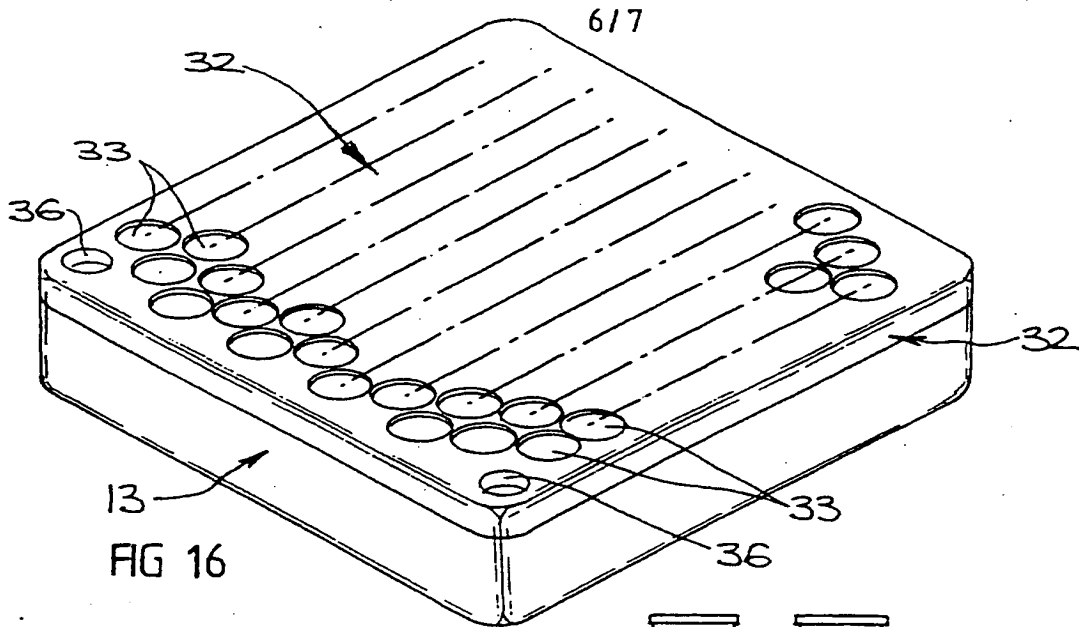
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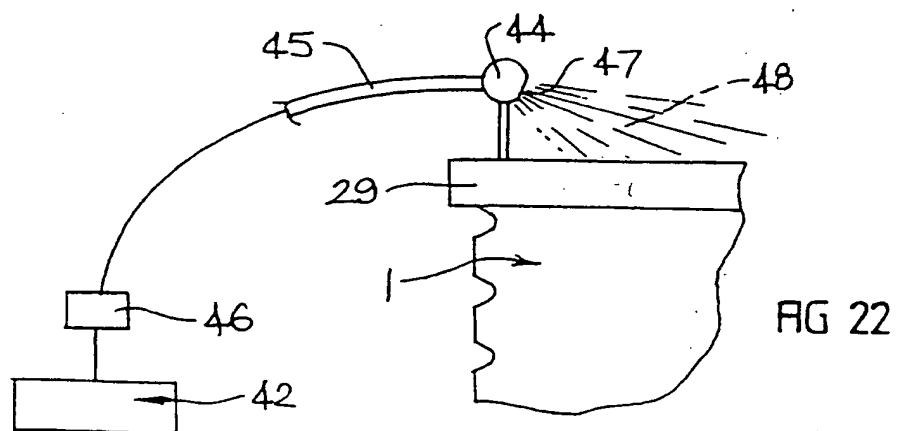
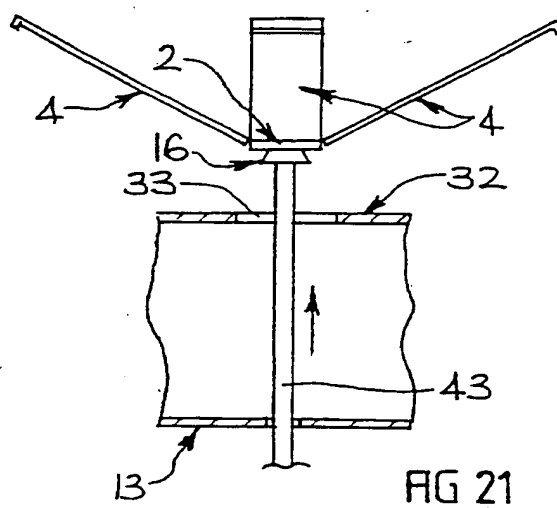
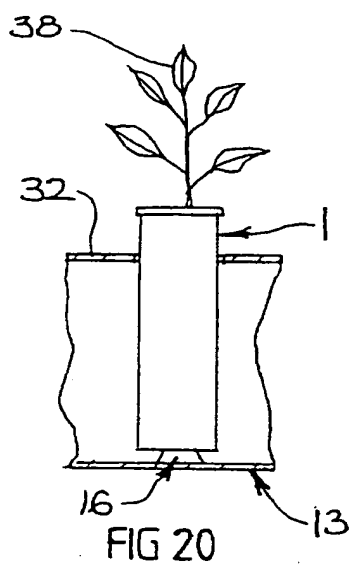
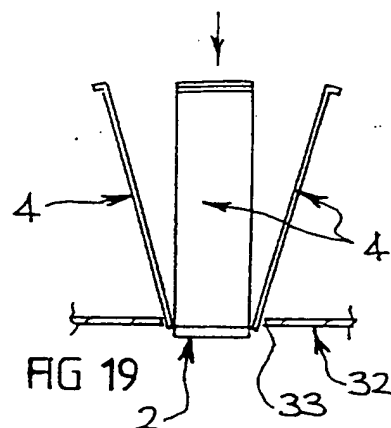
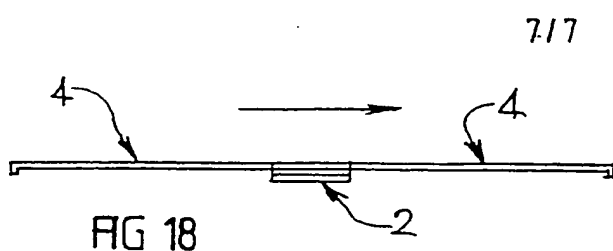


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INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00790

A. CLASSIFICATION OF SUBJECT MATTER												
Int Cl ⁶ : A01G 9/02, 9/10												
According to International Patent Classification (IPC) or to both national classification and IPC												
B. FIELDS SEARCHED												
Minimum documentation searched (classification system followed by classification symbols) IPC: A01G 9/02, 9/10												
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: IPC as above												
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DERWENT: IPC A01G 9/02, 9/10												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
X Y	US 4223480 (WELTY) 23 September 1980 Whole document	1-3,5-9,12,30 10,11,13-29,31-33										
X Y	US 1707551 (HALE) 2 April 1929 Whole document	1-3,5-9 15,19										
X Y	GB 2144015A1 (ASA PLASTICS LIMITED) 27 February 1985 Whole document	1-3,5-7,12,13,30 8,11,14-29,31-33										
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex												
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E" earlier document but published on or after the international filing date</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E" earlier document but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art											
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"P" document published prior to the international filing date but later than the priority date claimed												
Date of the actual completion of the international search 16 January 1997		Date of mailing of the international search report 3 FEB 1997										
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (06) 285 3929		Authorized officer R. KIRBY Telephone No.: (06) 283 2369										

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/AU 96/00790

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	FR 799115 (ROGER et al) 6 June 1936 Whole document	1-3,5-7,12,30 8-11,13-29,31-33
X Y	AU 68703/87 A1 (SHOWA DENKO K.K. et al) 18 August 1988 Whole document. Sides hinged to base as alternative, Page 5.	1-3,5-9 4
Y	AU 15285/66 (MacPHERSON) 12 June 1969 Separable hinge, Figures 1, 2	4
X Y Y	US 4059921 (MORIWAKI) 29 November 1977 Whole document Retaining means, items 8, 9 of Figures 2, 3, 4	1-3,6,8,9,12,13 13 10
X Y Y	US 1542683 (EVERETT) 16 June 1925 Whole document Retaining means, items 7, 8 of Figures 1-3	1-3,6,8,12,13 13 10
Y	Derwent Abstract Accession No. 93-376042/47, Class P13, SU 1774840 (BYKMUKHAMED) 7 November 1992 Retaining means, ring member item 3	14
Y	US 1959139 (OTWELL) 15 May 1934 Interlocking edges, A2 of Figures 1, 2	11
Y	AU 53643/73 B1 (468960) (FERAND) 26 September 1974 Interlocking edges, items 8, 9 of Figures 1, 2	11
Y Y	AU 18331/88 A1 (WHITCOMB et al) 19 October 1989 Apertured root guides for air pruning Retaining means Figures 1, 2, 3	10 12
Y	AU 51865/93 A1 (RONNEBY TREE FARM PTY LTD) 9 June 1994 Apertured root guides for air pruning	8,9,10
Y	AU 87546/75 B1 (507795) (ILLINOIS TOOL WORKS INC) 23 June 1977 Container positioning means, item 12 Figures 1-5	15-18,31,32
Y	AU 29728/77 A1 (ILLINOIS TOOL WORKS INC) 26 April 1979 Container positioning means and support tray, Figures 15, 16, 17	15-24,31,32
Y	AU 19051/48 B1 (141159) (ESSEX AERO LIMITED) 13 May 1948 Container positioning means and support tray, Figures 1, 2, 3	15-24,31,32

INTERNATIONAL SEARCH REPORT

AUSTRALIAN PATENT OFFICE
SEARCH REPORT

Application No.
AU 96/00790

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	AU 14032/62 B1 (266062) (CALLINAN) 6 August 1964 Container positioning means and support tray, Figures 3, 6, 8, 12	19-22, 25-29, 32
Y	GB 1444834 A1 (SCHMID) 4 August 1976 Container positioning means and support	15-20,31
Y	FR 1477621 (LAGUERRE) 21 April 1967 Container positioning means and support	15-20,31
Y	US 4092804 (MORRIS et al) 6 June 1978 Container positioning means and support	15,19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/AU 96/00790

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4223480						
GB	2144015						
AU	68703/87						
US	4059921	JP	52009607				
SU	1774840						
AU	53643/73	FR	2176632				
AU	18331/88	US	4939865				
AU	51865/93						
AU	87546/75	AR	20649	BR	7508700	CA	102659
		CA	1028859	CA	1028856	CA	1030818
		CH	604472	CY	961	DE	2557573
		DK	6/76	EG	12079	FI	753712
		FR	2296369	GB	1503219	GR	61109
		HK	492/78	IL	48764	JP	51091136
		KE	2867	LU	74069	MW	65/75
		MY	388/78	NL	7515135	NZ	179594
		SE	7514741	TR	19012	ZM	1/76
		US	4031832	AT	4791/75	IT	1052030
		BE	837252	IN	143995	NO	754215
		ZA	7507528				
Continued							

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/AU 96/00790

Patent Document Cited in Search Report				Patent Family Member			
AU	29728/77	AR	213136	AT	7708/77	BR	7707531
		CH	616052	DE	2747887	DK	5042/77
		FI	773214	FR	2370423	GB	1571145
		GB	1571146	IT	1090146	JP	53062647
		NL	7712452	NO	773898	NZ	185525
		PT	67274	SE	7711091	US	4192096
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US	4092804						
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